Comparison of sono-elastography and conventional sonography for differentiation of benign and malignant solid thyroid nodules

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Aims and objectives

Introduction:

Elastography is novel, evolving, non-invasive and fast expanding sonographic technique, which estimates stiffness of the tissue by assessing distortion under pressure.

Elastography is useful in differentiating malignant from benign thyroid nodules because malignant nodules are typically denser than benign nodules and thus are less responsive to applied stress compared with surrounding normal thyroid parenchyma.

B mode USG is definitive method for detection of thyroid nodules, however, the predictive value of US in diagnosis of malignant nodules is limited. Currently best available method to differentiate benign and malignant thyroid nodule in FNAC.

Aims and Objectives of the study:

1. To compare sensitivity and specificity of B-mode and sonoelastography in differentiating benign and malignant solitary thyroid nodules with cyto/histopathologic findings as reference standard.
2. To evaluate diagnostic performance of B mode and sonoelastography in differentiating benign and malignant solitary thyroid nodules.
Methods and materials

The study included 110 patients with solid thyroid nodule on grey scale US, and 20 patients were excluded according to exclusion criteria, so the total number of selected patients were 90 patients (66 females, mean age of 51 years, and 24 males, mean age of 42 years), seen from January 2014 till December 2014

**INCLUSION CRITERIA:**

All patients presenting with solitary solid thyroid nodule who underwent surgery or FNAC that are assessed with B-mode sonography were included.

**EXCLUSION CRITERIA:**

- Thyroid nodules with purely cystic component.
- Thyroid nodules with calcified shell.
- Thyroid nodules whose histopathological correlation not available.
- Thyroid nodules larger than probe width.

These patients were subjected to B-mode sonography and sonoelastography in the same sitting.

**REFERENCE STANDARD:**

Histopathology (post-surgery analysis) or cytopathology (FNA).

**METHOD OF PROCEDURE:**

All patients with thyroid nodules seen on B mode sonography were included.

Patients were subjected for B-mode ultrasonography in supine position with pillow underneath the shoulders to extend the neck. Following B-mode characteristics of thyroid nodule were assessed -
1. **Echogenicity:** Whether hyperechoic/ isoechoic/ hypoechoic with respect to normal thyroid parenchyma.

2. **Calcifications:** No calcifications/ microcalcifications (presence of hyperechoic spots <2 mm with or without acoustic shadowing)/ coarse dense calcifications /peripheral rim-like calcification.

3. **Presence of vascularity and its pattern on Doppler:** Absence of blood flow/ perinodular and absent intranodular blood flow/ intranodular blood flow.

4. **Perinodular hypoechoic halo.**

5. **Margins:** Well defined and smooth/ irregular/ spiculated.

These patients were evaluated by sono-elastography in the same setting and assigned Rago et al elastographic score according to stiffness depicted by color system.

Rago et al scoring of thyroid nodule -

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Elasticity in whole nodule</td>
</tr>
<tr>
<td>2</td>
<td>Elasticity in a large part of the nodule.</td>
</tr>
<tr>
<td>3</td>
<td>Elasticity only at the peripheral part of the nodule.</td>
</tr>
<tr>
<td>4</td>
<td>No elasticity in the nodule.</td>
</tr>
<tr>
<td>5</td>
<td>No elasticity in the nodule and in the posterior shadowing.</td>
</tr>
</tbody>
</table>

**CRITERIAS USED FOR SUSPICIOUS MALIGNANT NODULE:**

1. **Conventional ultrasound:** Nodules showing hypoechoogenicity, microcalcifications, irregular wall and intranodular vascularity on doppler.
2. **Elastography:** Scores 4 and 5.

**METHOD OF PERFORMING ULTRASOUND ELASTOGRAPHY EXAMINATION:**
After detailed B-mode ultrasound examination, the nodule was evaluated with the same real-time instrument and the same probe. The probe was placed on the neck with light pressure, and a rectangular region of interest was highlighted, which included the nodule and sufficient surrounding thyroid tissue to be evaluated.

The ultrasound elastogram was displayed over the B-mode image in a color scale that ranged from red for components with the greatest elastic strain (ie, softest components) to blue for those with no strain (ie, hardest components).

To minimize the interobserver and intraobserver variability, the freehand compression applied on the neck region was standardized by real-time measurement displayed on a numeric scale (graded 1-6) to maintain an intermediate level optimal for ultrasound elastographic evaluation. The nodule was compressed with ultrasound probe and gradually released. The adequacy of compression indicated by the side bar indicating green color. If the side-bar showed red or yellow color indicating inadequate compression, these images were discarded. Then the sonoelastographic pattern of nodule after adequate compression was evaluated and categorized according to five groups as categorized by Rago et al. The level of pressure was maintained constant throughout the examination.

Then the patients were followed for histo/ cytopathology.

Patient included in the study were subjected for measurement of serum calcitonin level. All patients included in the study had undetectable serum calcitonin levels which ruled out possibility of parathyroid solitary nodular lesion being falsely included in the study.

The results of B-mode ultrasonography and sonoelastography were compared with histo / cytopathology as reference standard.
Images for this section:

![Fig. 1: Solitary thyroid nodule elastographic scoring system by Rago et al.](image)

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Results

Histology:

Of 90 cases, 18 (20%) were malignant and 72 (80%) were benign at histology. Sensitivity and specificity of the US-elastography for thyroid cancer diagnosis were 89.4% and 94.7%, respectively; which was significantly higher as compared with B-mode sonography which had sensitivity and specificity 74.3% and 55% respectively. Accuracy of elastography for detection of malignant thyroid nodule was 91.2%.
Fig. 2: Thirty one year old female with solitary hypoechoic right thyroid nodule. US Elastography reveals elasticity score 1. This nodule proved to be follicular adenoma at histopathology.

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Fig. 3: Forty one year old female with solitary hypoechoic right thyroid nodule. US Elastography reveals elasticity score 2. This nodule proved to be papillary adenoma at histopathology.

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**Fig. 4:** Forty year old female with solitary hypoechoic, well defined thyroid nodule in isthmus and right lobe. US Elastography reveals elasticity score 2. This nodule proved to be follicular adenoma at histopathology.

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Fig. 5: Fifty seven year old female with solitary hypoechoic left thyroid nodule. US Elastography reveals elasticity score 2. This nodule proved to be papillary adenoma at histopathology.

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**Fig. 6:** Forty nine year old female with solitary hypoechoic left thyroid nodule. US Elastography reveals elasticity score 3. This nodule proved to be papillary carcinoma at histopathology.

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**Fig. 7:** Sixty year old male with solitary hypoechoic right thyroid nodule. US Elastography reveals elasticity score 4. This nodule proved to be papillary carcinoma at histopathology.

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Fig. 8: Fifty seven year old female with solitary hypoechoic right thyroid nodule. US Elastography reveals elasticity score 4. This nodule proved to be follicular carcinoma at histopathology.

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Fig. 9: Forty six year old female with solitary hypoechoic left thyroid nodule. US Elastography reveals elasticity score 5. This nodule proved to be papillary carcinoma at histopathology.
Conclusion

US elastography seems to have great potential as a new tool for differentiating solid thyroid nodules and for recommending FNAC. It is a promising technique that, combined with other US modalities, is easy and rapid to perform and can help to identify thyroid nodules that are likely to be malignant. Further prospective studies are needed.
References


